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# Population decline in the Rustic Bunting *Emberiza rustica* in Norway

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Since the expansion of the Rustic Bunting (*Emberiza rustica*) westwards in northern Europe during the 19th and 20th centuries, declines have been reported in Fennoscandia. The Norwegian population was 100–500 breeding pairs in 1994. We carried out censuses to detect Rustic Buntings in Norway during 2008–12, and compared these results with previous records to evaluate recent population changes. Transect censuses made along 15 km of optimal habitat (swamp forest along rivers) yielded 18 territories during 1972–78, but in 2008 we found only 5 territories, and none since 2011. We also detected Rustic Buntings in 21 of 74 previously-occupied sites (one or more records during 1963–2007). During the study period 2008–12, we recorded Rustic Buntings in 41 sites, with a maximum of 47 territories in 2008. However, from 2008 to 2012 we detected a decline of 82% (yearly decline of 34% ± 9%; 95% CI). Local extinctions occurred in at least 31 sites. The current known population size is 13 territories in 9 sites, and the true population size may be only slightly larger. About half of all territories were associated with beaver dams, but the rate of decline during 2008–12 did not depend on dams. Extinctions could be attributed to habitat loss or change in 9/53 sites (1 logging, 1 cultivation, and 7 loss of a beaver dam). We suggest that the population decline of Norwegian Rustic Buntings is due to factors operating during migration or in wintering areas.

## 1. Introduction

The distribution of the Rustic Bunting (*Emberiza rustica*) expanded westwards during the 19th and 20th centuries from the original range in the boreal forests of Russia. In 1880 it had reached halfway into Finland (Merikallio 1958) and in 1910 into northern Sweden (Svensson *et al.* 1999). By 1930 it had expanded south-westwards to Jämtland in central Sweden (Nilsson 1968), and the first documented breeding in Norway was in 1960 (Lundberg 1962), although it may have bred there already in 1938 (Krogh 1953). From around 1970 the Rustic Bunting has been widespread in eastern Norway, in particular Hedmark county (Sonerud & Bekken 1979), and in 1994 the Norwegian population size was estimated at 100–500 pairs (Gjershaug *et al.* 1994). Sonerud and Bekken (1979) attributed the colonization to the utilization of an empty niche in the boreal forests, whereas Staav (1976) suggested that in Sweden the re-expansion of the Eurasian Beaver (*Castor fiber*), af-

ter having been hunted to near-extinction, created suitable habitat for the Rustic Bunting because it prefers swamp forest.

The much larger populations of Rustic Buntings in both Finland and Sweden have recently declined (Ukkonen & Väisänen 1997, Svensson *et al.* 1999, Väisänen 2006, Lindström *et al.* 2012). In Sweden, the population has had an annual decline of at least 4.9% (based on standardized counts during 1998–2011) or as much as 11.1% (based on non-standardized counts during 1985–2011; Lindström *et al.* 2012), and the distribution range has contracted northwards (Svensson *et al.* 1999, L. Hansson pers. comm.). Thus, populations close to the main Norwegian population have declined the most. There have been no recent surveys of the Norwegian population size and distribution. The purposes of the present study were to provide an updated status for Rustic Buntings in Norway, and to assess recent population changes, and if these exist, to determine whether habitat changes in the breeding areas could explain population changes.

We assessed population changes by repeating line transect censuses made during the 1970's (Sonerud & Bekken 1979). Furthermore, our study covered five years (2008–12), and we also assessed whether there were population changes during this period. We evaluated changes in distribution range, and use of individual sites, by comparing historical data (1963–2007) with the current distribution (2008–12). In addition, we determined distribution changes occurring within the last five years. Svensson *et al.* (1999) suggested that the decline in Sweden might be related to recent logging and draining of swamp forests. Thus, we also recorded human impact in sites which had been occupied by Rustic Buntings in order to evaluate causes of population changes and assessed whether population trends were dependent on the presence or absence of beaver dams (Staav 1976).

## 2. Material and methods

### 2.1. Study species and study area

Rustic Buntings in Norway occur in the boreal taiga zone and prefer swamp forest with Norway Spruce (*Picea abies*) and Birch (*Betula pubescens*) along slow-flowing rivers in flat terrain, usually in proximity to bogs (Sonerud & Bekken 1979, Hansen 2009). Forest flooded by beaver dams can be present in nearly half of the territories (Hansen 2009). Rustic Buntings overwinter in eastern Asia (mainly China, Korea and Japan), and arrive to Norwegian breeding grounds in May. Males are territorial, and both male and female participate in raising young. They feed mostly on the ground, often close to wet areas or water, and feed young with insects, but are granivorous outside the breeding season (Cramp & Perrins 1994).

The core area of the distribution of Rustic Buntings has been in the county of Hedmark in eastern Norway, with smaller numbers in the neighbouring Oppland and Nord-Trøndelag counties in central Norway, at elevations of 210–610 m a.s.l. (Sonerud & Bekken 1979, Bekken 1994). Small numbers may also occur further north, including eastern Finnmark (Bekken 1994). We carried out censuses at potential breeding areas over the whole known distribution range in Hedmark, and visited most known sites in Oppland. Hedmark and Oppland covered roughly 80–90% of the known distribution of the Rustic Bunting in Norway (Bekken 1994). We did not include Nord-Trøndelag or Finnmark because these areas are not contiguous with the main distribution area, and numbers there are likely to be low (Bekken 1994; see also Discussion).

### 2.2. Censuses

We carried out censuses during May–June 2008–12 with a focus on the early-breeding-season period during which birds are vocal, beginning after their arrival in May and lasting until the first part of June. We did the censuses between sunrise and midday, and nearly always in good weather, ensuring that detection conditions were relatively homogeneous. We used standardized line transects in 2008, and during these counts we also recorded habitat types along the transects (Hansen 2009). Line transects followed water courses, and we used playback of Rustic Bunting song every 500 m to increase detection probability. Censuses in 2008 had the largest geographical coverage, from the municipality of Kongsvinger in the south to those of Rendalen and Engerdal in the north of Hed-

mark. We made censuses both in areas with previous records and in areas that seemed to contain suitable habitat based on inspection of topographical maps (M711 series, scale 1:50,000) and aerial photographs. We collated previous records of Rustic Buntings (during 1963–2007) from species-specific publications (mainly Sonerud & Bekken 1979), supplemented by searching all other relevant sources, such as local ornithological journals (published by local branches of the Norwegian Ornithological Society in most counties), internet-based observation databases (in particular www.artsobservasjoner.no run by the Norwegian Biodiveristy Information Centre), and correspondence with ornithologists with relevant knowledge.

In subsequent years, we concentrated censuses to regions in which Rustic Buntings were found in 2008, supplemented with visits to additional sites with previous records. During 2009–12 we focused censuses on suitable habitat and used playback of song frequently. Field work in 2010 was more restricted than in other years, and we were able to monitor only some sites with declining numbers. Thus, population changes involving data from 2010 should be interpreted with caution, but we included these to provide information on temporal trends in population size. In total, we carried out censuses during 70, 34, 4, 17 and 13 days in the years 2008–12, respectively. Censuses covered approximately 380 km in 2008, 270 km in 2009, 130 km in 2011 and 120 km in 2012. Across years, more than 550 km of suitable habitat was covered.

In 2008, we repeated line-transect censuses that had been conducted in three separate areas during 1972–78 by Sonerud and Bekken (1979). We visited these areas at approximately the same time of the year as previously. Sonerud and Bekken (1979) did not use playback of song. Thus, for two of the areas we did not use playback for the first census, but we returned later on for a second census using playback, as was done in all other areas in 2008. For one of the three areas (Østamyra), we made only one visit and used playback because in this area, most of the habitat had been lost to cultivation in the 1980s, and the census focused on determining whether any buntings remained in the remaining small habitat patches.

On the basis of previous records and observations of Rustic Buntings made during the study period (2008–12), we grouped recorded territories into sites. We defined "site" as being an area with more or less contiguous suitable habitat and with territories relatively close to each other. However, due to the small size and patchy distribution of much of the suitable habitat, many sites did not have more than one or two territories, and were separated from other sites by several kilometers. In total, we defined 107 sites: 87 with previous records (from the period 1963–2007) and 20 "new" sites in which we found Rustic Buntings during the study period (2008–12) but that had produced no previous records. We carried out censuses at a total of 74 sites with previous records during the study period. We did not visit the remaining 13 sites because information from observers and map inspections indicated that these sites were small, had only sub-optimal habitat, and/or were outside the main distribution (cf. Sonerud & Bekken 1979). Thus, these likely represented marginal areas without regular occurrence.

### 2.3. Habitat variables and habitat change

Hansen (2009) analysed habitat selection of Rustic Buntings in the present study area based on data from 2008. Habitat variables related to human activity (logging, ditches to drain forest, and man-made dams) occurred too infrequently to be included in multivariate analyses to assess factors affecting the presence/absence of Rustic Buntings. However, we found beaver dams in 42% of territories. Thus, to assess factors related to population change during the period of 2008–12, we compared sites with and without beaver dams.

Furthermore, we assessed whether habitat change could explain the disappearance of Rustic Buntings from sites that had historical records (1963–2007) but were not occupied during 2008–12 ($n = 53$). We first visited sites with previous records during 2008 ($n = 41$) and 2009 ($n = 12$). We recorded evidence for changes in the habitat quality since the last previous record of Rustic Buntings. We focused on anthropogenic influences. We scored the impact of logging as yes/no based on presence/absence of tree stumps assumed to be younger than the year of the last bunting record in combination with the age of regrowth. Because median year of the last bunting record was 1995,

Table 1. Number of Rustic Bunting territories recorded during line transects in three sites in Hedmark, eastern Norway during 1972–78 (Sonerud & Bekken 1979) and during 2008–11 (this study). – indicates that a site was not visited.

| Site | Transect length (km) | No. territories | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1972–78[1] | 2008[1] | 2008[2] | 2009[2] | 2011[2] | 2012[2] |
| Ulvådalen | 8 | 8 | 0 | 3 | 1 | 0 | 0 |
| Kynndalen | 3 | 5 | 2 | 1 | 0 | 0 | 0 |
| Østamyra | 4 | 5 | – | 0 | – | – | – |

1) Line transect without playback
2) Line transect with playback

and 40/53 sites had been used after 1983, we considered the time span to be sufficiently short to assess stump age. We scored the effect of draining as presence/absence of ditches assumed to originate from after the last bunting record. Due to possible clogging and regrowth of old ditches, we may have missed such impact for sites where buntings disappeared at an early time. We scored the effect of cultivation as present/absent within a distance of 100 m from the perimeter of sites (habitat patches) assumed to have previously contained territories.

We also recorded whether the construction of dams, roads or buildings had occurred within 100 m from the sites. Finally, we included presence/absence of beaver dams assumed to have been active at the time of the most recent bunting record. The number of sites scored as previous presence of a beaver dam should be considered approximate because of the possibilities that signs of beaver dams may have disappeared from sites with older bunting records, or that signs of a beaver dam do not indicate when it was established.

### 2.4. Analyses

We analyzed changes in the distribution by comparing the number of occupied sites in the period of 1963–2007 with that of the period of 2008–12, and also within the period of 2008–12. To illustrate spatial patterns of changes in the distribution, we defined a core area to consist of the municipalities of Trysil and Åmot in central Hedmark. These were the only municipalities in which Rustic Buntings were recorded in 2011–12. For analyses of changes in the distribution we defined "extinct" as cases with no buntings recorded in one or more years in sites that previously had one or more buntings (either during 1963–2007, or earlier during 2008–12). The opposite pattern – birds recorded in previously empty sites – was referred to as "colonization". Note that a given site could be classified as being both colonized and extinct; two sites had been colonized, but had gone extinct later on during the period 2008–12.

We analyzed population trends during 2008–12 in TRIM (version 3.53, Pannekoek & van Strien 2005), which uses log-linear models with a Poisson error distribution. We compared a model with time effects in yearly changes with a linear trend model using a Wald test (Pannekoek & van Strien 2005). The data used in these analyses consisted of all sites in which we had recorded buntings at least once during 2008–12 ($n = 41$ sites, 39 inventoried at least twice). We ran these analyses with correction for overdispersion and serial correlation. We based the total yearly counts and the slope for overall population trend on observed counts plus those estimated by TRIM (imputed values) for sites with missing values. TRIM recommends using imputed slopes rather than model-predicted slopes, because they are closer to real counts. We compared basic models with models in which the presence of beaver dams was included as a covariate. TRIM uses Wald tests to assess whether population-trend slopes differ between each level of a covariate, in our case to compare sites with or without beaver dams. For changes between 2008 and 2009 we also included coarse location as a covariate, i.e., whether a site was in the core area or not. For the latter analysis, TRIM

could not handle the whole period 2008–12 because all sites outside the core area were extinct in 2011.

## 3. Results

### 3.1. Recensuses of the 1972–78 line transects

Sonerud and Bekken (1979) did censuses in three sites using the line-transect method during 1972–78, resulting in 18 detected territories. In 2008 we found only five territories along these transects (Table 1). This represents a decline of 72% during ca. 30 years. Most parts of one site (Østamyra) had been cultivated in the meantime (see below). The decline in sites that had remained more or less unchanged in 2008 (Ulvådalen and Kynndalen) was 62%. However, the decline continued after 2008, and buntings at both sites were extinct in 2011 (Table 1).

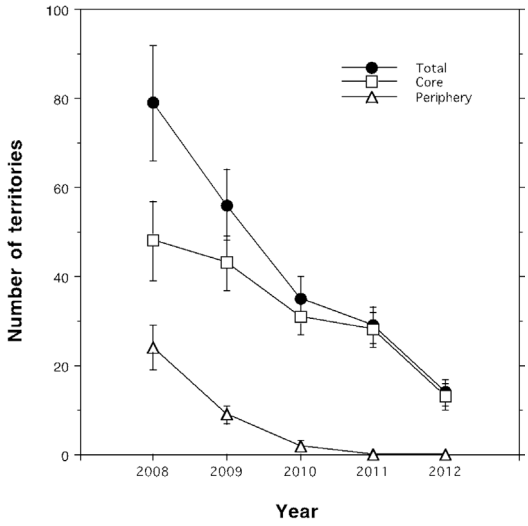


Fig. 1. Population trend of the Rustic Bunting in eastern Norway during 2008–12. Lines show estimated number of territories (with SE) based on TRIM models for the total population, and for the core and periphery (see text for definitions).

### 3.2. Population trends during 2008–11

The number of territories recorded in each of the five study years was (number of occupied sites in parentheses): 47 (28) in 2008, 42 (25) in 2009, 7 (5) in 2010, 24 (14) in 2011 and 13 (9) in 2012. Occupied sites had 1–7 territories (mean = 1.6, median = 1, $n$ = 81 site-years). A linear trend model in TRIM indicated a significant yearly decline of 34% ± 9% (95% CI; $P < 0.001$). Estimated population size in these sites decreased from 79 to 14 territories during 2008–12 (decline 82%; Fig. 1). A model with time effects indicated a yearly decline of 34% ± 9% (95% CI) and a total decline of 83% (from 82 to 14 territories). However, the model with time effects did not deviate significantly from a model with a linear trend (Wald test: $\chi^2 = 3.44$, df = 3, $P = 0.33$). A linear trend model, including beaver dam as a covariate, indicated that population trends did not differ between sites with and without beaver dams (Wald test: $\chi^2 = 0.32$, df = 1, $P = 0.57$; sites with a beaver dam: yearly decline 34% ±10% 95% CI, sites without a beaver dam: yearly decline 30% ± 24%; 95% CI). For the period 2008–09, population trends differed signficantly between sites within and outside the core area (Wald test: $\chi^2 = 4.19$, df = 1, $P = 0.041$; Fig. 1).

### 3.3. Changes in distribution

We revisited a total of 74 sites with previous records (during 1963–2007) of Rustic Buntings during 2008–12. We found buntings in at least one year in 21 sites (28%; note that some sites became extinct during 2008–12; see below), but did not record any in the remaining 53 sites (72%).

The distribution gradually contracted towards the core area consisting of the municipalities of Trysil and Åmot (see Material and methods). Among the 74 sites with previous records, extinctions occurring before 2008 took place in 11 of 21 sites (52%) in the core area, compared to 42 of 53 sites (79%) outside the present core area ($\chi^2 = 4.10$, df = 1, $P = 0.04$).

During the period of 2008–12, we recorded Rustic Buntings in a total of 41 sites, of which we visited 39 in at least two years. Rustic Buntings became extinct in 31 out of 39 (79%) of the latter sites. We recorded only four cases of colonization, two of which later became extinct. Seven sites were either stable (4) or declined without becoming extinct (3).

Sites that became extinct during 2008–12 were also predominantly outside the core area. Extinc-

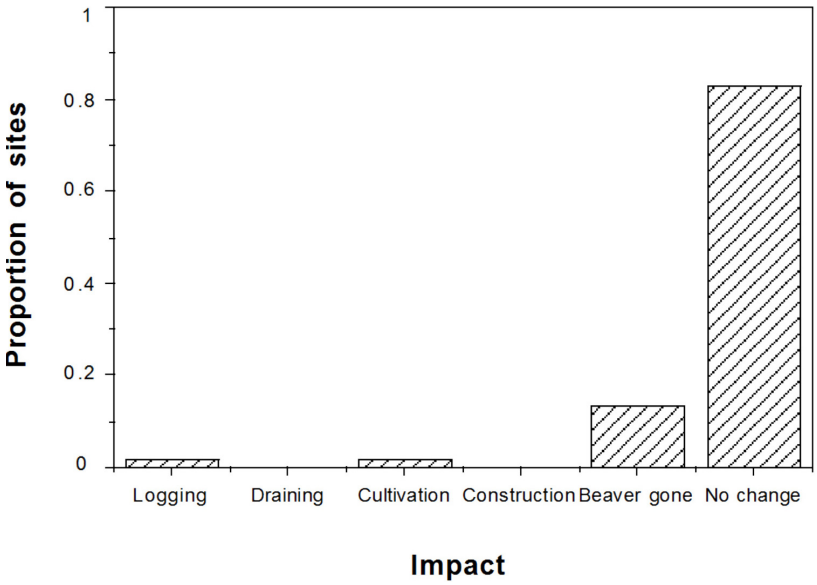


Fig. 2. Proportion of sites occupied by the Rustic Bunting during 1963–2007 but not during 2008–12 ($n$ = 53), which had been affected by human activities or had lost an active beaver dam after the last year buntings were recorded (see text for details).

tions occurred in 18 out of 26 (69%) sites in the core area, compared to all of the 13 sites outside the present core area ($\chi^2 = 3.32$, df = 1, $P = 0.07$).

We tested whether there was a time effect for extinctions. Sites that were occupied during 2008–12 had more recent previous records (median year 2000; $n = 21$) than sites that were no longer occupied (median year 1995; $n = 53$), but the difference was not significant ($U$ test, $z = –1.67$, $P = 0.10$).

### 3.4. Habitat changes

Among 53 sites that had Rustic Buntings during 1963–2007 but not during 2008–12, one site had been cultivated (Østamyra, in the 1980s), one had been affected by logging operations nearby it, and seven sites apparently had an active beaver dam when buntings had been observed, but not recently (Fig. 2). The remaining 44 sites did not show evidence of logging, draining, cultivation, human construction activity (e.g., roads) or a loss of beaver dam since the last year buntings had been observed (Fig. 2).

During 2008–12, we did not observe such changes in the occupied sites, except that a beaver dam in one site had been destroyed by the local anglers' association to support the spawning migration of fish; however, the site was still occupied by buntings in 2012.

## 4. Discussion

### 4.1. Changes in population size and distribution

Our results documented a recent strong and widespread decline of Rustic Buntings in Norway. During the period of 2008–12 we found a yearly rate of decline of 34%, and the remaining population, perhaps only 13 males (territories), was limited to a small area in central Hedmark. If the current decline continues, the species may become extinct in Norway in only a few years.

Our data also showed a strong decline since the 1970s. However, the species was probably more common and widespread during the 1980s and 1990s, perhaps even peaked in mid-1990s, but became increasingly difficult to find during the 2000s (T.W. Andersen, J. Bekken & G.A. Sonerud, pers. comm.). Thus, the rate of decline may have been larger than our data indicate if most of the decline has occurred only within the last ten years or so.

Our compilation of historical records indicated a total of at least 107 sites used by the Rustic Bunting at some time in the counties of Hedmark and Oppland, whereas the birds may currently be restricted to nine sites. One could argue that the use of sites might be dynamic, with frequent colonizations and extinctions, so that the number of sites

Table 2. Recent changes in population size of Rustic Buntings in Fennoscandia.

| Region | Period | Yearly change (%) | Total change | Comment | Source |
|---|---|---|---|---|---|
| *Finland* | | | | | |
| Nation-wide | 1983–2005 | | More than halved | | 1 |
| Nation-wide | 1979–2010 | –4.2 | | Strongest decline in south | 2 |
| *Sweden* | | | | | |
| Nation-wide | 1990s | | | Retracted towards north | 3 |
| Nation-wide | 1985–2011 | –11.1 | | Non-standardized counts | 4 |
| Nation-wide | 1998–2011 | –4.9 | | Standardized counts | 4 |
| Medelpad | 1980–2010 | | Reduction | Most sites abandoned | 5 |
| Dalarna | 2000–2010 | | Large reduction | Nearly extinct | 6 |
| Värmland | 1980–2012 | | Large reduction | Nearly extinct | 7 |
| Stora Fjäderägg | 1985–2006 | | –60% | Migration data | 8 |
| *Norway* | | | | | |
| Hedmark and Oppland | 2008–2012 | –33.9 | –82% | | 9 |

Sources: 1 = Väisänen (2006), 2 = R.A. Väisänen (pers. comm.), 3 = Svensson *et al.* (1999), 4 = Lindström *et al.* (2012), 5 = I. Marklund (pers. comm.), 6 = L. Hansson (pers. comm.), 7 = U.T. Carlsson (pers. comm.), 8 = Lindberg and Edenius (2007), 9 = this study.

occupied at a given point of time has always been lower than the total number of known sites. However, during 2008–12 we recorded 32 extinctions but only four colonizations, of which two actually became extinct shortly afterwards. Furthermore, although not statistically significant, sites that did not become extinct had recent sightings five years later (median 2000) than sites that became extinct (median 1995), a pattern which is not expected if there is a dynamic use of sites. Finally, our surveys also covered a large number of potential sites that were not used at all during 2008–12, including both sites with previous records and sites without previous records but with suitable habitat. These data suggest that the species' distribution does not fluctuate considerably, but is now restricted to a limited number of sites that are regularly occupied until extinction, and that rarely become occupied again. The TRIM model with a linear trend was more parsimonious than a model with time effects on the trend, suggesting that the rate of decline during 2008–12 was constant. The combination of a decline in historical data and a decline during 2008–12 suggest a consistent long-term population decline of Rustic Buntings in Norway.

The Norwegian population was estimated at 100–500 pairs in 1994 (Gjershaug *et al.* 1994). Our data do not provide an updated estimate of the historical population size, but it is worth noting that the transect censuses made in the 1970s indicated a density of 1.0–1.7 territories/km linear habitat. Data from a Swedish area near Norway indicated a density of 1.5 territories/km (Bylin 1975). We carried out censuses for a total of 550 km linear habitat where either Rustic Buntings have occurred or where there was suitable habitat. Furthermore, there are probably additional areas, particularly in peripheral areas of the range, where we did not carry out censuses, but which may have had buntings during the population peak. Thus, the peak population size may have been closer to the high than the low estimate from 1994. If the high estimate is correct, the population size has declined by 97% over the last 10–20 years.

We did not do censuses in previously-occupied sites in central and northern Norway. The only population estimate for these areas is for the county of Nord-Trøndelag, with 5–20 pairs in 1999 (Einvik & Solberg 1999). However, the highest yearly count was five males in 1982, and later on up to two territories have been found in a given year. The last observation was in 2006. Given the strong decline in the counties of Hedmark and Oppland, there may not be more than a few birds left in Nord-Trøndelag. Numbers observed further north in Norway have always been low. One possible bias is that potential sites for the Rustic Bunting in central and northern Norway are seldom visited by

ornithologists, but these may be regarded as peripheral populations that disappear during population declines (Dale 2001).

The Rustic Bunting has declined in regions of Sweden close to the main Norwegian distribution area (Svensson *et al.* 1999, L. Hansson pers. comm., U.T. Carlsson pers. comm.). During 2011, censuses were done in 50 km of suitable habitat in parts of Sweden near to the Norwegian distribution, and only two territories were found (Hansen 2011). In conclusion, the Norwegian population of Rustic Buntings appears extremely small, is declining rapidly, and may be isolated from any sizeable population in Sweden. Such small, isolated populations may go extinct by chance events within a short period of time. Data from Norway, Sweden and Finland suggest a large-scale, rapid decline in the western part of the species' distribution (Table 2).

### 4.2. Causes of decline

The Scandinavian populations of the Rustic Bunting, including that of Norway, have shown unusual population trajectories, with an expansion until the 1990s and a subsequent rapid decline. The expansion may partly have been related to beavers creating more suitable habitat (Staav 1976), although this does not explain the spread through Finland where beavers were extinct during the expansion phase that occurred more than 100 years ago (beaver reintroductions begun in 1935), and also the spread through northern Sweden does not match the return of beavers that took place only after 1922 (Halley & Rosell 2002). The recent decline in Sweden may be related to increased logging and draining of swamp forests during the 1980s, and currently 40% of Swedish swamp forests are affected by draining (Rudqvist 1999, Svensson *et al.* 1999). In Finland, 55% of the original mire area has been drained, and mire-indicator bird species (including Rustic Bunting) have declined by 40% over the last three decades (Biodiversity.fi 2012).

However, our data do not support a direct link between habitat change and population decline in Norway. Most sites previously occupied by the Rustic Bunting have apparently remained more or less unchanged. Some extinct sites may have lost active beaver dams, so the habitat may currently be drier than before. Beavers may also have declined recently in parts of the study area (S. Dale & K. Hansen, pers. obs.). On the other hand, more than half of the Rustic Bunting territories found in 2008 were not associated with beavers. During the increase phase, Sonerud and Bekken (1979) noted a beaver dam at only one of 13 sites. Finally, our analyses indicated that the current population trend did not depend on whether beaver dams were present or not at a site. Thus, the few habitat changes observed, or potential changes in the availability of beaver dams, may not be among the main reasons for the decline of the Rustic Bunting in Norway.

As we have no data on breeding success, we cannot exclude the possibility that an undetected factor not related to our measures of habitat change may be operating. However, some males do not seem to succeed in attracting a female (Hansen 2009). Low recruitment of females to a population is typical of small and isolated populations (Dale 2001), and may reflect a general population decline across the distribution, which causes insufficient recruitment to edge populations in particular. This may explain the faster rate of decline in Norway than in Sweden and Finland (Table 2), and the Norwegian tendency for sites outside the core area to decline faster than within the core area (Fig. 1). The decline in Sweden and Finland may also point to large-scale factors behind the decline, especially because in Finland the draining of bogs and swamp forest apparently does not decrease population densities (Ukkonen & Väisänen 1997).

We believe that the decline may be related to factors operating during migration or in the wintering areas. The main wintering areas of the Rustic Bunting are in East Asia where conditions for many species are deteriorating rapidly. In China, both habitat loss and change, and bird hunting, are widespread (BirdLife International 2003). Five Rustic Buntings ringed in Sweden have been recovered in China, three of them at bird markets (Fransson *et al.* 2007, 2009). More than a million Yellow-breasted Buntings (*Emberiza aureola*) are captured every year in connection with an annual food festival in the Guangdong province (Tamada 2006). Problems in wintering areas would result in low survival rates between years on the breeding

grounds, but the population dynamics of Rustic Buntings in Fennoscandia have not been examined yet. Studies in the wintering areas in China are needed in order to determine the importance of habitat destruction and hunting, and to identify possible measures to mitigate the decline. Although the Norwegian population is not of major importance for conservation of the global population of the Rustic Bunting, the steep decline in combination with negative trends in other parts of Fennoscandia act as strong warning signals that this species has serious problems that may be affecting the whole population across the Palaearctic region.

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### Norjan pohjansirkkukannan väheneminen

Pohjansirkku (*Emberiza rustica*) levittäytyi länteen pohjoisessa Euroopassa 1800- ja 1900-luvuilla, mutta viimeaikaiset havainnot viittaavat sen vähentyneen Fennoskandiassa. Norjan pohjansirkkupopulaatio oli 100–500 pesimäparia vuonna 1994. Laskimme pohjansirkkuja jaksolla 2008–12 ja vertailimme tuloksia vanhoihin havaintoihin selvittääksemme populaation muutoksia. Linjalaskennat (15 km suotuisissa ympäristöissä: jokivarsien soistuneet metsät) tuottivat 18 reviiriä 1972–98, 2008 enää viisi eikä yhtään 2011. Lajia löytyi 21 paikalta 74:stä sellaisesta paikasta, joilta oli vähintään yksi havainto jaksolta 1963–2007.

Tutkimusjaksolla 2008–12 havaitsimme lajin 41 paikassa, enimmillään 47 reviiriä vuonna 2008. Kuitenkin arvioimme kannan laskeneen 82 % jaksolla 2008–12 (vuotuinen lasku 34 % ± 9 %, 95 % luottamusväli). Paikallisia häviämisiä oli vähintään 31 paikassa.

Tämänhetkinen tunnettu populaatio koostuu 13 reviiristä yhdeksässä paikassa, ja todellinen populaatio lienee vain hieman suurempi. Noin puolella reviireistä havaittiin majavan patorakennelma, mutta väheneminen 2008–12 ei riippunut siitä, oliko paikassa pato vai ei. Häviäminen voitiin liittää ympäristön muuttumiseen yhdeksässä tapauksessa 53:sta (1 hakkuu, 1 maanviljely, 7 majavapadon häviäminen). Uskomme, että lajin väheneminen Norjassa riippuu talvehtimisalueella tai muuttoreitillä vaikuttavista tekijöistä.

## References

Bekken, J. 1994: Vierspurv *Emberiza rustica*. — In Norsk fugleatlas (eds. Gjershaug, J.O., Thingstad, P.G., Eldøy, S. & Byrkjeland, S.): 500–501. Norsk Ornitologisk Forening, Klæbu, Norway. (In Norwegian)

Biodiveristy.fi (2012): Mires. — www.biodiversity.fi/en/indicators/mires (retrieved 29 March 2012).

BirdLife International. 2003: Saving Asia's threatened birds: a guide for government and civil society. — BirdLife International, Cambridge.

Bylin, K. 1975: Dalarnas fåglar. — Dalarnas Ornitologiska Förening, Gävle, Sweden. (In Swedish)

Cramp, S. & Perrins, C.M. 1994: The Birds of the Western Palearctic. Vol. IX Buntings and New World Warblers. — Oxford University Press, Oxford.

Dale, S. 2001: Female-biased dispersal, low female recruitment, unpaired males, and the extinction of small and isolated bird populations. — Oikos 92: 344–356.

Einvik, K. & Solberg, B. 1999: Rødlistestatus for truete og sårbare arter i Nord-Trøndelag. — Rapport 1/1999, Miljøvernavdelingen, Fylkesmannen i Nord-Trøndelag, Norway. (In Norwegian)

Fransson, T., Kolehmainen, T. & Staav, R. 2007: Svensk ringmärkning 2006. — In Fågelåret 2006 (eds. Bentz, P.-G. & Wirdheim, A.): 19–25. Sveriges Ornitologiska Förening, Stockholm. (In Swedish)

Fransson, T., Jansson, L., Kolehmainen, T., Kroon, C. & Wenninger, T. 2009: Nytt återfynd av videsparv i Kina. — Ringinform 32: 32. (In Swedish)

Gjershaug, J.O., Thingstad, P.G., Eldøy, S. & Byrkjeland, S. 1994: Norsk fugleatlas. — Norsk Ornitologisk Forening, Klæbu, Norway. (In Norwegian)

Halley, D.J. & Rosell, F. 2002: The beaver's reconquest of Eurasia: status, population development and management of a conservation success. — Mammal Review 32: 153–178.

Hansen, K. 2009: Status of the rustic bunting (*Emberiza rustica*) in Norway – a study of distribution, population size and habitat preferences. — Master thesis, Norwegian University of Life Sciences, Ås, Norway. (In Norwegian with English summary)

Hansen, K. 2011: Vierspurvprosjektet – status 2011. — Fylkesmannen i Hedmark, Miljøvernavdelingen. Report 2/2011. (In Norwegian)

Krogh, K. 1953: Vidjespurven (*Emberiza rustica* Pall.) i Lierne, Nord-Trøndelag. — Fauna 6: 70–76. (In Norwegian)

Lindberg, N. & Edenius, L. 2007: Stora Fjäderäggs fågelstation 2006. — In Fågelåret 2006 (eds. Bentz, P.-G. &

Wirdheim, A.): 156–157. Sveriges Ornitologiska Förening, Stockholm. (In Swedish)

Lindström, Å., Green, M. & Ottvall, R. 2012: Monitoring population changes of birds in Sweden. Annual report for 2011. — Department of Biology, Lund University, Sweden. (In Swedish with English summary)

Lundberg, S. 1962: Videsparv med ungar vid Gratangen. — Sterna 5: 34. (In Swedish)

Merikallio, E. 1958: Finnish birds. Their distribution and numbers. — Fauna Fennica 5: 1–181.

Nilsson, N. 1968: Anteckningar om videsparvens (*Emberiza rustica*) förekomst i Jämtland. — Fauna och flora 63: 100–102. (In Swedish)

Pannekoek, J. & van Strien, A. 2005: TRIM 3 Manual (TRends & Indices for Monitoring data). — Statistics Netherlands, Voorburg, Netherlands.

Rudqvist, L. 1999: Sveriges sumpskogar. Resultat av sumpskogsinventeringen 1990–1998. — Skogsstyrelsen, Jönköping, Sweden. (In Swedish)

Sonerud, G.A. & Bekken, J. 1979: The distribution of the rustic bunting in Norway and its habitat preferences in Hedmark county. — Vår Fuglefauna 2: 78–85. (In Norwegian with English summary)

Staav, R. 1976: Distribution and observations during migration of rustic buntings *Emberiza rustica* in Sweden. — Fauna och flora 71: 202–207. (In Swedish with English summary)

Svensson, S., Svensson, M. & Tjernberg, M. 1999: Svensk Fågelatlas. — Sveriges Ornitologiska Förening, Stockholm. (In Swedish)

Tamada, K. 2006: Population change of grassland birds over ten years in Nakashibetsu, eastern Hokkaido. — Ornithological Science 5: 127–131.

Ukkonen, M. & Väisänen, R.A. 1997: *Emberiza rustica* Rustic Bunting. — In The EBCC Atlas of European Breeding Birds: Their Distribution and Abundance (eds. Hagemeijer, W.J.M. & Blair, M.J.): 754. T & AD Poyser, London.

Väisänen, R.A. 2006: Monitoring population changes of 86 land bird species breeding in Finland in 1983–2005. — Linnut-vuosikirja 2005: 83–98. (In Finnish with English summary)